Planning Overview
Year 5 Addition and Subtraction

Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)
Add and subtract numbers mentally with increasingly large numbers
Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why

NF–2 Apply place-value knowledge to known additive and multiplicative number facts (scaling facts by 1 tenth or 1 hundredth

<table>
<tr><th></th><th>Teaching and Learning</th></tr>
<tr><td>Introduction</td><td>Children will have covered a range of strategies in the Year 4 addition and subtraction unit and then applied these strategies within the decimals and measures units of work. Assess children's retention of these methods using the activity below.

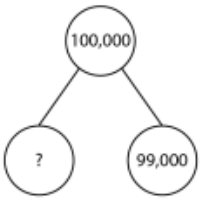
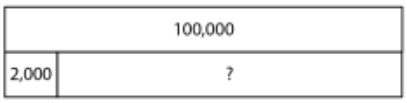
Which is the most efficient way to solve each of the calculations below?

<table>
<tr><th>Recall</th><th>Mental Strategies</th><th>Mental Strategies with jottings</th><th>Written Methods</th></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>

0.7 + 0.3 =
6,072 – 501 =
£10 – £8.89 =
5,539 – 752 =
606 + 1,042 =
4,956 + 1,432 =
340m + 239m + 260m =
1.2m – 0.4m =

Can children explain why they have positioned each calculation in each section?

Can the children create an extra addition and subtraction calculation for each section of the grid?</td></tr>
</table>

Add and subtract numbers mentally with increasingly large numbers – (Scaling known facts)	Children should be able to recognise when known facts will help them with a calculation. Give children the calculation 5 + 4 = 9 and ask what related/known facts they can derive. Based on their learning from Y4 they should be able to give examples such as 5,000 + 4,000 = 9,000, 0.5 + 0.4 = 0.9, 900 – 400 = 500. Extend to working with numbers at a Y5 level e.g. 50,000 + 40,000 = 90,000. Ensure that children can use the correct vocabulary *'I know that thirty plus seventy equals one hundred.'* *'So thirty thousand plus seventy thousand equals one hundred thousand.'* NCETM PD Materials • Unitising 3 + 7 = 10 3,000 + 7,000 = 10,000 • *'I know that three plus seven equals ten.'* • *'So three thousand plus seven thousand equals ten thousand.'* Complements to 100,000: • Part-part-whole models   Ask the children what's the same and what's different about the known fact and related fact. I know that ninety nine add one equals one hundred so I know that ninety nine thousand add one thousand equals one hundred thousand Same Different I know that ninety nine add one equals one hundred so I know that ninety nine thousand add one thousand equals one hundred thousand The numbers in the related fact calculation are one thousand times bigger than the known fact so the answer is one thousand time bigger.

<table>
<tr>
<td></td>
<td>
Extend to decimals if appropriate e.g. 86.7 + 13.3 = 100 what else do you know?

Explore what happens when the tens and hundreds boundaries are crossed using place value counters to support the pattern if needed.
7 + 4 = 11
70 + 40 = 110
700 + 400 = 1,100
7,000 + 4,000 = 11,000
70,000 + 40,000 = 110,000

Ensure children also write the subtraction facts linked to a calculation.

Use models and images if the children are struggling to see the relationship between the known and related facts.

Consider other known facts such as scaling doubles and looking for near doubles.

• Doubling
16,000 + 16,000 = ☐
180,000 + 180,000 = ☐

Children to take 1 calculation and see how many related calculations they can establish from that known calculation.

Ensure that children can apply what they have learnt to missing box questions e.g. 60,000 – ? = 54,000
</td>
</tr>
<tr>
<td>Add and subtract numbers mentally with increasingly large numbers – Using place value to calculate</td>
<td>
Following on from the addition and subtraction in the Place Value unit encourage the children to look at the parts of the number and consider how can this help calculation.

400,000 + 80,000 + 5,000 =

Highlight the areas on the chart below and add together.

<table>
<tr><td>1,000,000</td><td>2,000,000</td><td>3,000,000</td><td>4,000,000</td><td>5,000,000</td><td>6,000,000</td><td>7,000,000</td><td>8,000,000</td><td>9,000,000</td></tr>
<tr><td>100,000</td><td>200,000</td><td>300,000</td><td>400,000</td><td>500,000</td><td>600,000</td><td>700,000</td><td>800,000</td><td>900,000</td></tr>
<tr><td>10,000</td><td>20,000</td><td>30,000</td><td>40,000</td><td>50,000</td><td>60,000</td><td>70,000</td><td>80,000</td><td>90,000</td></tr>
<tr><td>1,000</td><td>2,000</td><td>3,000</td><td>4,000</td><td>5,000</td><td>6,000</td><td>7,000</td><td>8,000</td><td>9,000</td></tr>
<tr><td>100</td><td>200</td><td>300</td><td>400</td><td>500</td><td>600</td><td>700</td><td>800</td><td>900</td></tr>
<tr><td>10</td><td>20</td><td>30</td><td>40</td><td>50</td><td>60</td><td>70</td><td>80</td><td>90</td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr>
</table>

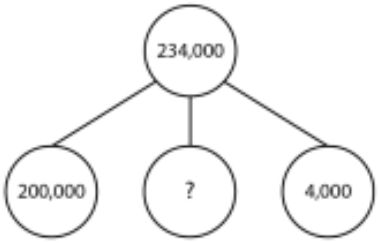
Children to use and apply their place value understanding to solve a range of calculations.
</td>
</tr>
</table>

Addition – missing-number problems:
'Fill in the missing numbers.'

234,000 = 100,000 + 130,000 + 4,000

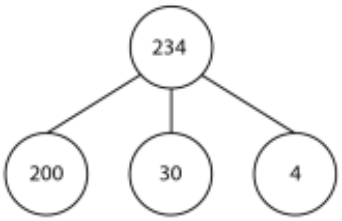
234,000 = ☐ + 100,000 + 100,000

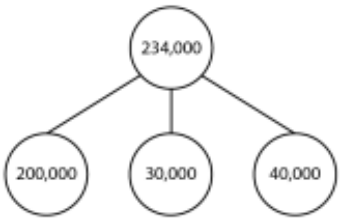
234,000 = 120,000 + 4,000 + ☐



Children to also recognise and use known facts and scaling to make larger calculations easier to tackle – see guidance below

Addition – part–part–part–whole models:





234 = 200 + 30 + 4

so

234 thousand = 200 thousand + 30 thousand
+ 4 thousand

that is

234,000 = 200,000 + 30,000 + 4,000

NCETM PD materials

Repeat for subtraction.

Subtraction calculations:

'Fill in the missing numbers.'

234,000 – 2,000 = ☐	234 – 2 = ☐
234,000 – 4,000 = ☐	234 – 4 = ☐
234,000 – 20,000 = ☐	234 – 20 = ☐
234,000 – 30,000 = ☐	234 – 30 = ☐
234,000 – 100,000 = ☐	234 – 100 = ☐
234,000 – 200,000 = ☐	234 – 200 = ☐

Dòng nǎo jīn:

'Find a pair of multiples of 1,000 that complete this equation. And another pair. And another pair…'

612,000 + ☐ – ☐ = 512,000

'What is the same about the relationship between each pair of numbers that you chose?'

NCETM PD materials

Look at patterns of calculations and discuss what's the same and what's different about the numbers.

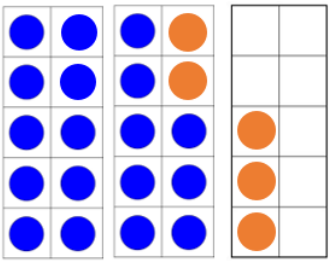
400,000 + 30,000 + 50 =
400,000 + 40,000 + 50 =
400,000 + 50,000 + 50 =
400,000 + 60,000 + 50 =
400,000 + 60,000 + 75 =

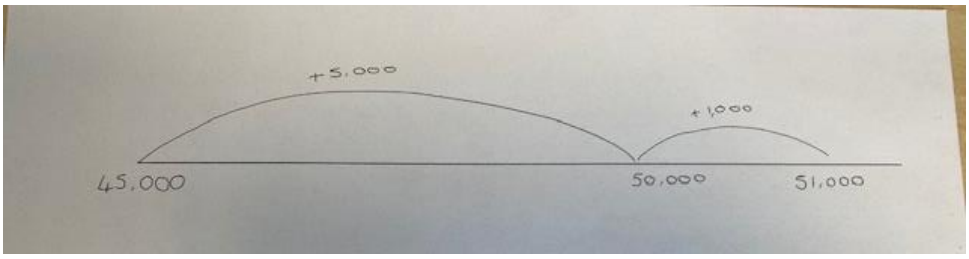
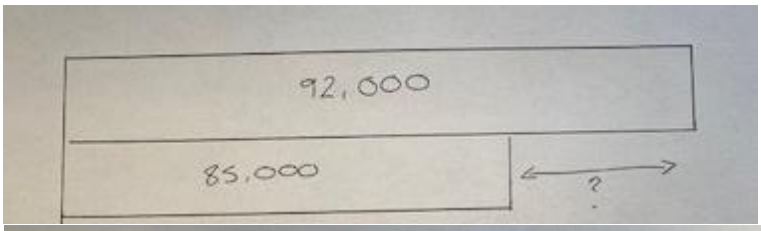
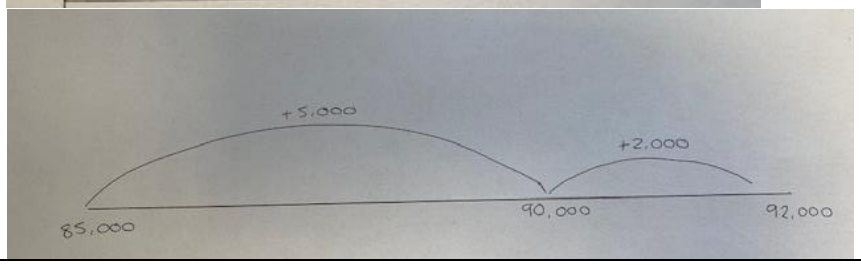
What is the impact of the last calculation? This is the first time that there has been an impact on the ones column.

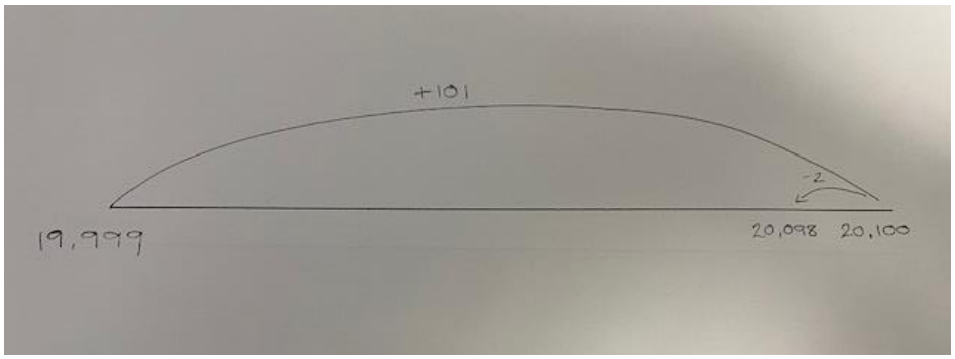
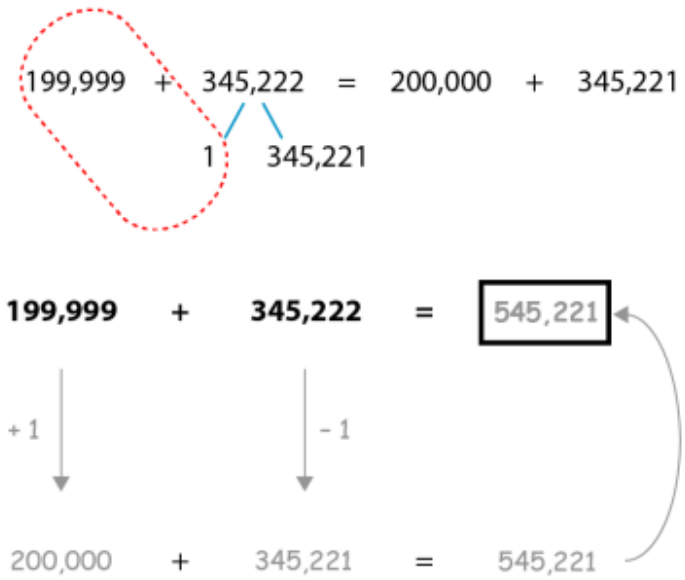
Extension
Consider what will happen for calculations where we end up with more than 9 in a place value column in addition. We will need to exchange in these calculations. (Children will tackle calculations where exchange will be needed in the bridging objective, but this can be used as an opportunity to reason as to why these are more difficult to calculate with just their place value knowledge.

e.g.
312,883 + 300 =

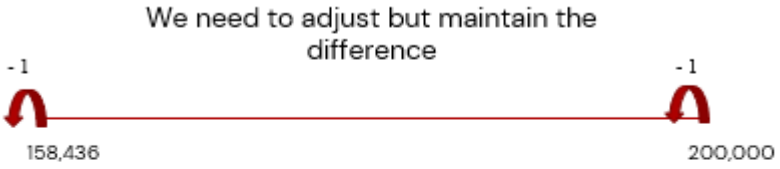
419,956 + 600 =

Add and subtract numbers mentally with increasingly large numbers - Using partitioning to calculate	Extend Place Value Addition and Subtraction to partitioning. Look at using partitioning to solve calculations with larger numbers e.g. 234,500 + 242,200 = Children reason what types of calculations partitioning would be an efficient strategy for - ones that don't require any exchange or very few exchanges. Children sort calculations into calculations where this would be an efficient strategy and calculations where a written strategy or another mental strategy would be more efficient.
Add and subtract numbers mentally with increasingly large numbers – Bridging	The tens frame can be used as a model to support bridging using number bonds if children have not secured this understanding in previous year groups e.g. each counter represents 100 to show 1.800 + 500 1,800 + 500 = 1,800 + 200 + 300 = 2,300  <u>or</u> 2,300 – 500 = 2,300 – 300 – 200 = 1,800 Relate to scaled facts 15,000 – 7,000 = 15,000 – 5,000 – 2,000 = ☐ 284,000 + 37,000 = 284,000 + 16,000 + 21,000 = ☐ 305,000 – 12,000 = 305,000 – 5,000 – 7,000 = ☐ • Bridging 7,000 + 5,000 = ☐ 37,000 + 45,000 = ☐ 87,000 + 65,000 = ☐ NCETM PD materials How have you partitioned each of the numbers to support with bridging? E.g. 7,000 + 5,000 = 7,000 + 3,000 + 2,000 Model how bridging can also be used as an efficient way to calculate the difference. Children will have covered this in Y4 addition and subtraction and applied to decimals, money and measure (assess and track back if needed.)

	Can children apply to larger numbers and missing box problems e.g. 51,000 – 45,000  92,000 - ? = 85,000 (A bar model can help children to understand how to tackle missing box questions. In this question we know the big number so we know the value of the whole bar. We only know one of the small numbers so the ? is the other small number. This is called the difference model)  
Add and subtract numbers mentally with increasingly large numbers - reordering calculations	What is the most efficient way of calculating the answer to this question? 2,400 + 850 + 600 + 50 = What facts have you used? Model how this can work with calculations that include addition and subtraction, what different ways could you complete this calculation 146 + 58 – 26 = e.g. calculate 58-26 then add on to 146 or take 26 away from 146 and then add 58 to 146. Does the order with which you tackle this calculation make a difference to the answer? Why is this? ***'If I choose to do this calculation as 146-26+58 or as 58+26-146 I get the same answer which is 178. This is because addition and subtraction and commutative'*** Provide children with other calculations where a different order would make the calculation easier.

Add and subtract numbers mentally with increasingly large numbers – compensating and adjusting	Compensating is taught in Y4, adjusting is taught in Y4 to those children who have confidently grasped all other methods. (Assess and make the decision about which children will grasp and retain these strategies – track back to smaller numbers as needed) Relate this strategy to larger numbers e.g. 19,999 + 99 What could we do to these numbers? How could we compensate for what we have done after we have answered the question? A blank number line may help some children see how to compensate.  *'Instead of adding 99 to 19,999 I added 101. I did this by adding the 1 first and then the 100. I had to compensate for what I did by subtracting 2 from my answer as the difference between 99 and 101 is 2'* Also look at the concept of adjusting as appropriate When adding we add to one side of the calculation and subtract from the other side to maintain the balance  Image taken from NCETM PD materials

But when subtracting we take the same amount from both sides to maintain the difference between the two numbers. Here by adjusting both sides to make them both 1 smaller we maintain the difference however we have created an easier calculation.



Same difference:

$$200,000 \xrightarrow{-1} 199,999$$
$$-\,158,436 \xrightarrow{-1} -\,158,435$$

How would children adjust or compensate to answer these calculations?

7.1 + 1.9 = ☐

7.0 + ☐ = ☐

2.6 + 3.9 = ☐

2.5 + ☐ = ☐

2.91 + 3.24 = ☐

3.0 + 3.15 = ☐

175.7 + 24.86 = ☐

176 + ☐ = ☐

Consider how to compensate/adjust to balance these calculations

57 + 24 = 58 + ☐

57 + 24 = ☐ + 22

☐ + 24 = 47 + 34

57 + ☐ = 37 + 44

Calculations taken from NCETM PD Materials

Children apply what they know about adjusting and compensating calculations to answer this question – they need to explain their reasoning rather than solve the calculations.

<table>
<tr><td></td><td>

Mastery with Greater Depth

True or False?

- 3999 – 2999 = 4000 – 3000
- 3999 – 2999 = 3000 – 2000
- 2741 – 1263 = 2742 – 1264
- 2741 + 1263 = 2742 + 1264
- 2741 – 1263 = 2731 – 1253
- 2741 – 1263 = 2742 – 1252

Explain your reasoning.

Using this number statement, 5222 – 3111 = 5223 – 3112 write three more pairs of equivalent calculations.

Pupils should not calculate the answer to these questions but should look at the structure and relationships between the numbers.

</td></tr>
<tr><td>Add and subtract numbers mentally with increasingly large numbers – fact families and inverse operations</td><td>

Inverses

Use the number facts triangle and bar model to explore the relationship between addition and subtraction.

How could you use these models and images to help you to decide what operation to use in calculations like these:

If using a bar model use the strategy of children identifying what they know about each missing box calculation – do we know the parts or the whole?

234 + ? = 653

(we know the whole and one part so this is a subtraction calculation)

<table>
<tr><td colspan="2">653</td></tr>
<tr><td>234</td><td>?</td></tr>
</table>

817 – ? = 345

(we know the whole and one part so we are subtracting)

<table>
<tr><td colspan="2">817</td></tr>
<tr><td>345</td><td>?</td></tr>
</table>

? – 431 = 256

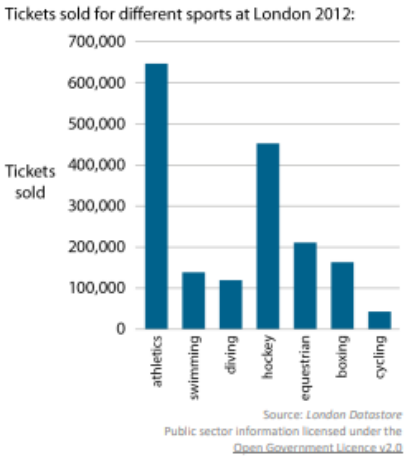
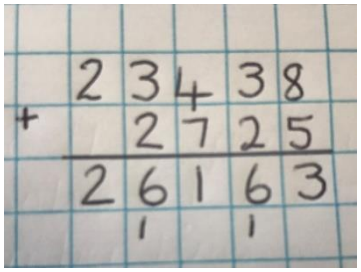
(we don't know the whole so we are adding the two parts)

<table>
<tr><td>431</td><td>256</td></tr>
<tr><td colspan="2">?</td></tr>
</table>

Children use a bar model to help them to check the answer to some calculations that they have been given.

Can they find any calculations that they know are incorrect before checking them?

</td></tr>
</table>

Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy	Discuss with the children why it might be good to estimate an answer before you tackle a calculation. Recap on rounding to support estimation. Provide the children with a calculation e.g. 395 + 412. What would be a good estimation for the answer? How could we use rounding to help us? What would the best numbers be to round to? Model rounding to the nearest 100. 400 + 400 = 800. What is the actual answer? Is your estimation near? Can it help you check you have the right answer? What about if we round this number to the nearest 10? Will the estimation be more precise? Is the calculation as easy to do mentally? Which would be the best estimation? Children to use rounding to give approximate answers to calculations – Graph taken from NCETM PD Materials  Source: London Datastore Public sector information licensed under the Open Government Licence v2.0 Answer questions on data such as the graph above but to round each events ticket numbers to a suitable number before calculating. E.g. approximately how many more people watched the athletics than the boxing? Children to use rounding to check the answers to calculations. Estimation can now be consolidated as the children recap written strategies with larger numbers. Ensure that the children estimate the answer to each question before solving them.
Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)	Adding and subtracting two 4-digit numbers is covered in Y4 Extend to adding and subtracting two 5-digit and two 6-digit numbers. Complete questions that have no bridging and then extend to cross boundaries. When children are secure, give questions where the number of digits are different in each number. Ensure children line the digits up correctly. 

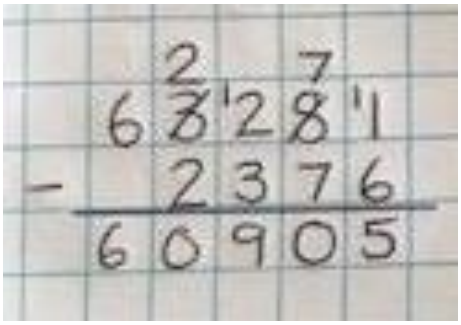
Can children find the missing number in calculations?

Can they throw a dice to fill 12 spaces to try and make the closest total to 100,000?

Word Problems
Over a year a catering company sells sandwiches on brown bread that earns them £357,847. They also sell sandwiches on white bread that earns the £643,743. How much money did the company make in total?

Repeat for subtraction, initially with no exchange and then with exchange.

Extend to working with a different number of digits in each number.



Word problem
Harry sold his house for £254,600. He bought it for £175, 850. How mcuh profit did he make?

????? + 12,423 = 2? 536

What numbers could replace the question marks?

Can you find 5 different ways?

Mastery

Set out and solve these calculations using a column method.

3254 + ☐ = 7999

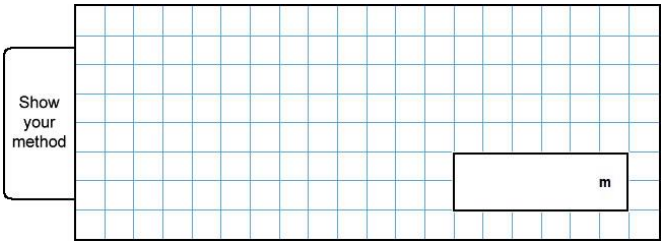
2431 = ☐ – 3456

6373 – ☐ = 3581

6719 = ☐ – 4562

<table>
<tr>
<td>Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why – selecting efficient methods</td>
<td>Revisit the activity from the introduction at the start of the unit. Give children calculations with 5 and 6-digit numbers and ask them to sort them into the correct column.
<table>
<tr><th>Recall</th><th>Mental Strategies</th><th>Mental Strategies with jottings</th><th>Written Methods</th></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>
When children have sorted the calculations ask them to compare with their partner and discuss where they have placed the calculations.

Children with differences need to try to convince each other that where they have sorted it is the most efficient way. Can they change each other's minds?</td>
</tr>
<tr>
<td>Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why – solving problems</td>
<td>Provide the children with a selection of problems for them to calculate using addition and subtraction. Also encourage children to reflect on whether they need a mental or written method. Would the bar model help them to solve the problem?

Use a range of past SATs questions at Year 5 level to allow children to begin to access this style of question e.g. This table shows the heights of three mountains.
<table>
<tr><th>Mountain</th><th>Height in metres</th></tr>
<tr><td>Mount Everest</td><td>8,848</td></tr>
<tr><td>Mount Kilimanjaro</td><td>5,895</td></tr>
<tr><td>Ben Nevis</td><td>1,344</td></tr>
</table>
How much higher is Mount Everest than the combined height of the other two mountains?


</td>
</tr>
</table>

This table shows the number of people living in various towns in England.

Town	Population
Bedford	82,448
Carlton	48,493
Dover	34,087
Formby	24,478
Telford	166,640

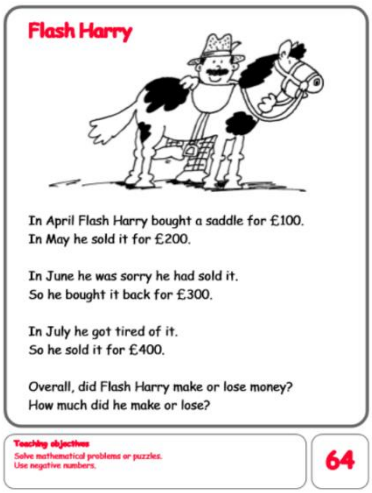
What is the **total** of the numbers of people living in Formby and in Telford?

1 mark

What is the **difference** between the numbers of people living in Bedford and in Dover?

1 mark

Substantial problem solving – Maths Challenges for Able Pupils


Flash Harry

In April Flash Harry bought a saddle for £100.
In May he sold it for £200.

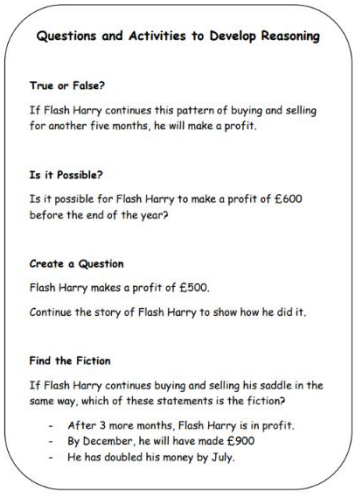
In June he was sorry he had sold it.
So he bought it back for £300.

In July he got tired of it.
So he sold it for £400.

Overall, did Flash Harry make or lose money?
How much did he make or lose?

Teaching objectives
Solve mathematical problems or puzzles.
Use negative numbers.

64


Questions and Activities to Develop Reasoning

True or False?

If Flash Harry continues this pattern of buying and selling for another five months, he will make a profit.

Is it Possible?

Is it possible for Flash Harry to make a profit of £600 before the end of the year?

Create a Question

Flash Harry makes a profit of £500.

Continue the story of Flash Harry to show how he did it.

Find the Fiction

If Flash Harry continues buying and selling his saddle in the same way, which of these statements is the fiction?

- After 3 more months, Flash Harry is in profit.
- By December, he will have made £900
- He has doubled his money by July.

Make 200

1 2 3 4 5 6 7 8 9

Choose four of these digits.
Each one must be different.
Put one digit in each box.

This makes two 2-digit numbers reading across and two 2-digit numbers reading down.
Add up all four of the numbers.

In this example the total is 100.

12 + 47 + 14 + 27 = 100

1	2
4	7

How many different ways of making 200 can you find?

83

Teaching objectives
Solve mathematical problems or puzzles.
Know what each digit represents.
Add several two-digit numbers.

Questions and Activities to Develop Reasoning

Agree or Disagree?

To make 200, the digit in the top left box cannot be a 9.

Do you agree or disagree?

Possible Answers

What are the possible answers you can make using only prime digits?

Would You Rather?

Would you rather have the highest total using only odd digits or the highest total using only even digits?

Silly Answers

What would be a silly answer for the number in the top left box if you were trying to make 100? What about 300?